

Importation of
Chinese Cabbage (*Brassica pekinensis*), Kohlrabi (*B. oleracea* var *gongylodes*)
and Pak-choi (*B. chinensis*)

from Mexico

into the United States

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A. Introduction

This pest risk assessment (PRA) was conducted by the United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA, APHIS, PPQ) on species of *Brassica* from Mexico. The results are expressed qualitatively, *i.e.* "high" or "low", rather than quantitatively, *i.e.* probabilities or frequencies. The risk assessment methodology and rating criteria are not included; these can be found in the document: *Pathway-Initiated Pest Risk Assessment: Guidelines for Qualitative Assessments* (USDA, 1995) (available from the authors of this risk assessment and on the Internet at <http://www.aphis.usda.gov/ppq/bats/bant>). Authority for APHIS to regulate plant pest/plant products is derived from the Plant Quarantine Act of 1912, the Plant Pest Act of 1957 and the Noxious Weed Act of 1974 and the Code of Federal Regulations, Title 7, Part 319, Subpart 56 (7 CFR 319.56 - Fruits and Vegetables). The methods and terminology used to initiate, conduct, and report this PRA are consistent with guidelines provided by FAO (1995) and NAPPO (1995).

B. Risk Assessment

1. Initiating Event: Proposed Action

This commodity-based, pathway-initiated, PRA was conducted to assess the risks associated with chinese cabbage (*Brassica pekinensis*), kohlrabi (*B. oleracea* var. *gongylodes*) and pak-choi (*B. chinensis*) from Mexico. Chinese cabbage, kohlrabi and pak-choi are currently permitted entry into the United States from Mexico. Because no genus level risk assessment was ever performed solely for Mexico, this abbreviated PRA was conducted in order to meet the requirements of current international standards.

Concomitantly, this assessment will also consider the historical records and recommendations for other Mexican *Brassica* species, particularly cabbage, *B. oleracea* var. *capitata*. Due to a history of *Copitarsia* interceptions in cabbage from Mexico, this PRA will also consider the pest risk of *Copitarsia* on that commodity.

2. Assessment of Weediness Potential of *Brassica* spp.

The results of the weediness screening for *B. pekinensis*, *B. oleracea* var. *gongylodes* and *B. chinensis* (Table 1) did not prompt a pest-initiated risk assessment.

Table 1: Process for Determining Weediness Potential of a Plant Species

Species: *Brassica* spp.

Phase 1: Brassicas are widely represented in the United States, both native and introduced species. Many species are cultivated.

Phase 2: Are any species listed in:

- | | |
|-------------------------|---|
| <u>Yes</u> ¹ | <i>Geographical Atlas of World Weeds</i> (Holm <i>et al.</i> , 1979) |
| <u>NO</u> | <i>World's Worst Weeds</i> (Holm <i>et al.</i> , 1977) |
| <u>NO</u> | <i>Report of the Technical Committee to Evaluate Noxious Weeds; Exotic Weeds for Federal Noxious Weed Act</i> (Gunn & Ritchie, 1982) |
| <u>Yes</u> ² | <i>Economically Important Foreign Weeds</i> (Reed, 1977) |
| <u>Yes</u> ³ | Weed Science Society of America list (WSSA, 1989) |
| <u>Yes</u> | Is there any literature reference indicating weediness (e.g., <i>AGRICOLA</i> , <i>CAB</i> , <i>Biological Abstracts</i> , <i>AGRIS</i> ; search on "species name" combined with "weed"). |

Phase 3: Conclusion:

These species are widespread in the United States, and do not meet the definition of a Federal noxious weed. However, some *Brassica* species do pose a weed threat and are neither included nor approved in this Assessment (see annotations).

¹Four Brassica species are listed in the Geographical Atlas as world weeds: *B. adpressa* (=*Hirschfeldia incana*), *B. alba* (=*Sinapis alba*), *B. armoracioides*, *B. campestris* (=*B. rapa* var. *rapa*), *B. hirta* (=*S. alba*), *B. incana* (=*H. incana*), *B. juncea*, *B. kaber* (=*S. arvensis*), *B. napus*, *B. nigra*, *B. rapa*, *B. rugosa*, *B. sinapistrum*, *B. tournefortii*.

²Four species (or synonyms) of *Brassica* are included in Economically Important Foreign Weeds: *B. incana* and *B. adpressa* (both =*H. incana*), *B. erucastroides* (=*Sisymbrium septulatum*), *B. tournefortii*.

³Eleven Brassicas are listed in the WSSA publication: *B. alba* (=*B. hirta*) (=*S. alba*), *B. arvensis* (=*B. kaber*), (=*S. arvensis*), *B. campestris* (=*B. rapa* var. *rapa*), *B. geniculata* (=*H. incana*), *B. hirta* (=*S. alba*), *B. incana* (=*H. incana*), *B. juncea*, *B. kaber* (=*S. arvensis*), *B. nigra*, *B. rapa*, *B. tournefortii*.

All of the above are widespread in the United States (and do not meet the definition of Federal noxious weed), except for the following: *B. armoracioides*, a principal weed of the former Soviet Union; *B. rugosa*, a weed of Argentina and a common local weed of India; *B. sinapistrum*, a weed in the former Soviet Union; *B. erucastroides* (=*Sisymbrium septulatum*), a weed of Russia, Iraq, Iran, Afghanistan; *B. tournefortii* (a weed of Australia, Europe, Egypt, New Zealand, and Israel) has been introduced into Arizona, California, Nevada and Texas, and is considered a weed.

A literature search on the first four species revealed little or no information, indicating that these four are unlikely candidates for the Federal Noxious Weed list. However, Mediterranean mustard (*B. tournefortii*) may be a candidate for risk assessment and potential listing. It is of limited distribution and may be economically important. Propagative parts of this species should be excluded from approval.

3. Previous Risk Assessments, Current Status and Pest Interceptions

Decision History for *Brassica* spp. from Mexico

- 1947 - Mexico - *Brassica juncea* - Entry approved through all Ports.
 1947 - Mexico - *Brassica oleracea* - Entry approved through all Ports.
 1936 - Mexico - *Brassica pekinensis* - Entry approved through all Ports.
 1932 - Mexico - *Brassica oleracea* - Entry approved through all Ports.
 1924 - Mexico - *Brassica oleracea* var *caulo-rapa* - Entry approved through all Ports.
 1924 - Mexico - cabbage, caulifolowr - Entry approved through all Ports.
 1923 - Mexico - cabbage - Entry approved through Laredo.
 1923 - Mexico - cabbage, cauliflower - Entry approved through all Ports.

Pests associated with *Brassica* spp. in Mexico

Pest Interceptions on *Brassica* from Mexico - FY85-95

| PEST | HOST |
|-------------------|--|
| Agromyzidae sp. | <i>Brassica</i> sp. (leaf) |
| Agromyzidae sp. | <i>Brassica juncea</i> (leaf) |
| Agromyzidae sp. | <i>Brassica chinensis</i> (leaf) |
| Agromyzidae sp. | <i>Brassica oleracea</i> (leaf) |
| Agromyzidae sp. | <i>Brassica oleracea</i> var <i>acephala</i> |
| Agromyzidae sp. | <i>Brassica rapa</i> (leaf) |
| Aleyrodidae sp. | <i>Brassica</i> sp. (leaf) |
| Altica sp. | <i>Brassica oleracea</i> (leaf) |
| Anthomyiidae sp. | <i>Brassica oleracea</i> (leaf) |
| Anthonomus sp. | <i>Brassica oleracea</i> (leaf) |
| Aphididae sp | <i>Brassica oleracea</i> (leaf) |
| Aphididae sp. | <i>Brassica</i> sp. (leaf) |
| Aphididae sp. | <i>Brassica rapa</i> (leaf) |
| Apis mellifera | <i>Brassica oleracea</i> |
| Arctiidae sp. | <i>Brassica</i> sp. (leaf) |
| Arctiidae sp. | <i>Brassica oleracea</i> (leaf) |
| Arhyssus sp. | <i>Brassica</i> sp. |
| Blapstinus sp. | <i>Brassica</i> sp. (leaf) |
| Blapstinus sp. | <i>Brassica oleracea</i> (fruit) |
| Blapstinus sp. | <i>Brassica oleracea</i> (leaf) |
| Blissus sp. | <i>Brassica oleracea</i> (leaf) |
| Catorhintha sp. | <i>Brassica oleracea</i> (leaf) |
| Ceratocapsus sp. | <i>Brassica</i> sp. (leaf) |
| Ceratocapsus sp. | <i>Brassica oleracea</i> (leaf) |
| Chaitophorus sp. | <i>Brassica</i> sp. (stem) |
| Chlorochroa sp. | <i>Brassica oleracea</i> (leaf) |
| Chrysomelidae sp. | <i>Brassica</i> sp. (leaf) |
| Chrysomelidae sp. | <i>Brassica oleracea</i> (leaf) |
| Chrysomelidae sp. | <i>Brassica rapa</i> (leaf) |
| Cicadellidae sp. | <i>Brassica</i> sp. (stem) |
| Cicadellidae sp. | <i>Brassica</i> sp. (leaf) |

| | |
|------------------------------|---------------------------------|
| Cicadellidae sp. | Brassica oleracea (leaf) |
| Colecerus sp. | Brassica oleracea (fruit) |
| Conotrachelus sp. | Brassica oleracea (leaf) |
| Copitarsia sp. | Brassica sp. (stem) |
| Copitarsia sp. | Brassica sp. (leaf) |
| Copitarsia sp. | Brassica sp. (fruit) |
| Copitarsia sp. | Brassica rapa (leaf) |
| Copitarsia sp. | Brassica oleracea (flower) |
| Copitarsia sp. | Brassica oleracea (fruit) |
| Copitarsia sp. | Brassica oleracea (leaf) |
| Copitarsia sp. | Brassica oleracea (stem) |
| Copitarsia sp. | Brassica oleracea |
| Copitarsia sp. | Brassica oleracea var. botrytis |
| Copitarsia sp. | Brassica oleracea var. capitata |
| Copitarsia sp. | Brassica pekinensis (leaf) |
| Corythucha sp. | Brassica oleracea (leaf) |
| Creontiades sp. | Brassica chinensis (leaf) |
| Creontiades sp. | Brassica rapa (leaf) |
| Curculionidae sp. | Brassica oleracea (leaf) |
| Cyrtopeltis sp. | Brassica sp. (leaf) |
| Dactynotus sp. | Brassica oleracea (leaf) |
| Dallasiellus sp. | Brassica sp. (leaf) |
| Delia sp. | Brassica sp. (leaf) |
| Delia sp. | Brassica oleracea (stem) |
| Delia sp. | Brassica oleracea var. capitata |
| Delia sp. | Brassica oleracea (leaf) |
| Delphacidae sp. | Brassica oleracea (leaf) |
| Delphacodes sp. | Brassica sp. (leaf) |
| Diabrotica sp. | Brassica chinensis (leaf) |
| Diabrotica sp. | Brassica oleracea (leaf) |
| Diabrotica tibialis | Brassica oleracea (leaf) |
| Diabrotica undecimpunctata | Brassica pekinensis (leaf) |
| Diabrotica undecimpunctata | Brassica sp. (leaf) |
| Diabrotica u. duodecimnotata | Brassica oleracea (leaf) |
| Diabrotica u. duodecimnotata | Brassica oleracea (fruit) |
| Diabrotica variegata | Brassica sp. (leaf) |
| Diabrotica variegata | Brassica oleracea (fruit) |
| Diabrotica variegata | Brassica oleracea (leaf) |
| Diaphania sp. | Brassica sp. (fruit) |
| Diaphania sp. | Brassica oleracea (fruit) |
| Diaphania sp. | Brassica oleracea (leaf) |
| Didymosphaeria sp. | Brassica sp. (leaf) |
| Empoasca sp. | Brassica rapa (leaf) |
| Empoasca sp. | Brassica oleracea (leaf) |
| Euschistus sp. | Brassica sp. (leaf) |
| Exitianus obscurinervis | Brassica chinensis (leaf) |

| | |
|-------------------------|---------------------------------|
| Frankliniella sp. | Brassica sp. (leaf) |
| Frankliniella sp. | Brassica sp. |
| Geometridae sp. | Brassica oleracea (leaf) |
| Gracillariidae sp. | Brassica sp. (leaf) |
| Gryllus sp. | Brassica sp. (leaf) |
| Gryllus sp. | Brassica sp. |
| Gryllus sp. | Brassica oleracea (leaf) |
| Hellula sp. | Brassica oleracea (leaf) |
| Heraeus sp. | Brassica oleracea (leaf) |
| Hyalmenus sp. | Brassica oleracea (leaf) |
| Ligyrocoris sp. | Brassica oleracea (leaf) |
| Ligyrocoris sp. | Brassica rapa (leaf) |
| Lopidea sp. | Brassica oleracea (leaf) |
| Lygaeidae sp. | Brassica oleracea (leaf) |
| Lygaeidae sp. | Brassica rapa (leaf) |
| Lygus sp. | Brassica sp. (leaf) |
| Lygus sp. | Brassica oleracea (leaf) |
| Lygus sp. | Brassica pekinensis (leaf) |
| Lygus sp. | Brassica pekinensis (leaf) |
| Macrodactylus sp. | Brassica oleracea var. botrytis |
| Macrodactylus mexicanus | Brassica oleracea var. botrytis |
| Membracidae sp. | Brassica sp. (leaf) |
| Membracidae sp. | Brassica oleracea (leaf) |
| Miridae sp. | Brassica sp. (leaf) |
| Miridae sp. | Brassica oleracea (fruit) |
| Monoxia sp. | Brassica oleracea (leaf) |
| Neoconocephalus sp. | Brassica oleracea (leaf) |
| Neopamera sp. | Brassica oleracea (leaf) |
| Noctuidae sp. | Brassica sp. (leaf) |
| Noctuidae sp. | Brassica oleracea (stem) |
| Noctuidae sp. | Brassica oleracea |
| Noctuidae sp. | Brassica oleracea var. capitata |
| Noctuidae sp. | Brassica rapa (leaf) |
| Noctuidae sp. | Brassica oleracea (leaf) |
| Nodonota sp. | Brassica oleracea (leaf) |
| Nysius sp. | Brassica sp. (leaf) |
| Nysius sp. | Brassica oleracea |
| Nysius sp. | Brassica oleracea (leaf |
| Oedionychus sp. | Brassica oleracea (leaf) |
| Pachybrachis sp. | Brassica sp. (leaf) |
| Parthenicus sp. | Brassica sp. (leaf) |
| Pentatomidae sp. | Brassica sp. (leaf) |
| Phera centrolineata | Brassica oleracea (leaf) |
| Pieridae sp. | Brassica juncea (leaf) |
| Pieridae sp. | Brassica oleracea (leaf) |
| Pieridae sp. | Brassica oleracea var. capitata |

| | |
|-------------------------|---------------------------|
| Pieris rapae | Brassica sp. (leaf) |
| Pieris rapae | Brassica oleracea (leaf) |
| Plutellidae sp. | Brassica oleracea (leaf) |
| Prosaldius sp. | Brassica oleracea (leaf) |
| Prytanes sp. | Brassica oleracea (leaf) |
| Pseudococcidae sp. | Brassica sp. (leaf) |
| Psylla sp. | Brassica oleracea (leaf) |
| Psylliodes sp. | Brassica sp. (leaf) |
| Pterophoridae sp. | Brassica sp. (leaf) |
| Pyralidae sp. | Brassica oleracea (leaf) |
| Pyraustinae sp. | Brassica chinensis (leaf) |
| Spanagonicus sp. | Brassica oleracea (leaf) |
| Spodoptera sp. | Brassica oleracea (leaf) |
| Systema sp. | Brassica sp. |
| Systema sp. | Brassica oleracea (leaf) |
| Systema sp. | Brassica sp. (leaf) |
| Trichoplusia intermixta | Brassica oleracea (leaf) |

4. Pests associated with *Brassica* spp. in Mexico

Table 2: Pests Associated With *Brassica* spp.

| Arthropoda | | | | |
|---|---------------------------|-------------------------|---|--|
| Pest | Distribution ¹ | Code ² | References | |
| Agromyzidae sp. (Diptera) | MX | n, x, z _i | PPQ Interception | |
| <i>Agrotis ipsilon</i> (Hufnagel) (Lepidoptera: Noctuidae) | MX, US | c, o | Hill, 1975; Hodges <i>et al.</i> , 1983; McGuire and Crandall, 1967 | |
| Aleyrodidae sp. (Homoptera) | MX | n, y, z _e | PPQ Interception | |
| <i>Altica</i> sp. (Coleoptera: Chrysomelidae) | MX | n, z _e | PPQ Interception | |
| Anthomyiidae sp. (Diptera) | MX | n, z _e | PPQ Interception | |
| <i>Anthonomus</i> sp. (Coleoptera: Curculionidae) | MX | n, z _e | PPQ Interception | |
| Aphididae sp. (Homoptera) | MX | n, x, y, z _e | PPQ Interception | |

Table 2: Pests Associated With *Brassica* spp.

| | | | |
|---|--------|------------------------------------|---|
| <i>Aphis gossypii</i> Glover (Homoptera: Aphididae) | MX, US | c, o, y | McGuire and Crandall, 1967 |
| <i>Apis mellifera</i> L. (Hymenoptera: Apidae) | MX | b, h | PPQ Interception |
| <i>Arctiidae</i> sp. (Lepidoptera) | MX | n, z _e | PPQ Interception |
| <i>Arhyssus</i> sp. (Heteroptera: Rhopalidae) | MX | n, z _e | PPQ Interception |
| <i>Ascia monuste</i> (L.) (Lepidoptera: Pieridae) | MX, US | c, o | Hodges <i>et al.</i> , 1983; Zhang, 1994 |
| <i>Blapstinus</i> sp. (Coleoptera: Tenebrionidae) | MX | n, z _e , z _i | PPQ Interception |
| <i>Blissus</i> sp. (Heteroptera: Lygaeidae) | MX | n, z _e | PPQ Interception |
| <i>Brevicoryne brassicae</i> (L.) (Homoptera: Aphididae) | MX, US | c, o | McGuire and Crandall, 1967; Metcalf and Metcalf, 1993 |
| <i>Catorhintha</i> sp. (Heteroptera: Coreidae) | MX | n, z _e | PPQ Interception |
| <i>Ceratocapsus</i> sp. (Heteroptera: Miridae) | MX | n, z _e | PPQ Interception |
| <i>Chaitophorus</i> sp. (Homoptera: Aphididae) | MX | n, z _e | PPQ Interception |
| <i>Chlorochroa</i> sp. (Heteroptera: Pentatomidae) | MX | n, z _e | PPQ Interception |
| <i>Chrysomelidae</i> sp. (Coleoptera) | MX | n, z _e | PPQ Interception |
| <i>Cicadellidae</i> sp. (Homoptera) | MX | n, y, z _e | PPQ Interception |
| <i>Colecerus</i> sp. (Coleoptera: Curculionidae) | MX | n, z _e | PPQ Interception |
| <i>Conotrachelus</i> sp. (Coleoptera: Curculionidae) | MX | n, z _e | PPQ Interception |

Table 2: Pests Associated With *Brassica* spp.

| | | | |
|--|--------|---------------------------------------|--|
| <i>Copitarsia</i> sp. (Lepidoptera: Noctuidae) | MX | n, z _e , z _i | PPQ Interception; Martell, 1974a; McGuire and Crandall, 1967; |
| <i>Copitarsia consueta</i> Walker (Lepidoptera: Noctuidae) | MX | n, z _e , z _i | Martell, 1974a; McGuire and Crandall, 1967 |
| <i>Corythucha</i> sp. (Heteroptera: Tingidae) | MX | n, z _e | PPQ Interception |
| <i>Creontiades</i> sp. (Heteroptera: Miridae) | MX | n, z _e | PPQ Interception |
| <i>Curculionidae</i> sp. (Coleoptera) | MX | n, y, z _e | PPQ Interception |
| <i>Cyrtopeltis</i> sp. (Heteroptera: Miridae) | MX | n, z _e | PPQ Interception |
| <i>Dactynotus</i> sp. (Homoptera: Aphididae) | MX | n, z _e | PPQ Interception |
| <i>Dallasielius</i> sp. (Heteroptera: Cydnidae) | MX | n, z _e | PPQ Interception |
| <i>Delia</i> sp. (Diptera: Anthomyiidae) | MX | n, z _e | PPQ Interception |
| <i>Delia platura</i> (Meigen) (Diptera: Anthomyiidae) | MX, US | c, o | McGuire and Crandall, 1967; Stone <i>et al.</i> , 1965 |
| <i>Delphacidae</i> sp. (Homoptera) | MX | n, y, z _e | PPQ Interception |
| <i>Delphacodes</i> sp. (Homoptera: Delphacidae) | MX | n, y, z _e | PPQ Interception |
| <i>Diabrotica</i> sp. (Coleoptera: Chrysomelidae) | MX | n, y, z _e | PPQ Interception |
| <i>Diabrotica tibialis</i> (Jacoby) (Coleoptera: Chrysomelidae) | MX, TX | n, y, z _e | PPQ Interception; Wilcox, 1975 |
| <i>Diabrotica undecimpunctata</i> Mannerheim (Coleoptera: Chrysomelidae) | MX | n, y, z _e , z _i | PPQ Interception |

Table 2: Pests Associated With *Brassica* spp.

| | | | |
|---|--------|---------------------------------------|--|
| <i>Diabrotica virgifera virgifera</i> (Harold) (Coleoptera: Chrysomelidae) | MX, TX | n, y, z _e , z _i | PPQ Interception; Smith, 1966 |
| <i>Diabrotica variegata</i> Jacoby (Coleoptera: Chrysomelidae) | MX | n, y, z _e , z _i | PPQ Interception |
| <i>Diaphania</i> sp. (Lepidoptera: Pyralidae) | MX | n, z _e , z _i | PPQ Interception |
| <i>Empoasca</i> sp. (Homoptera: Cicadellidae) | MX | n, y, z _e | PPQ Interception |
| <i>Epitrix</i> spp. (Coleoptera: Chrysomelidae) | MX | n, y, z _e | McGuire and Crandall, 1967 |
| <i>Estigmene acrea</i> (Drury) (Lepidoptera: Arctiidae) | MX, US | c, o | Hodges <i>et al.</i> , 1983; Martell, 1974a |
| <i>Euschistus</i> sp. (Heteroptera: Pentatomidae) | MX | n, z _e | PPQ Interception |
| <i>Euzophora osseatella</i> Treitschke (Lepidoptera: Pyralidae) | MX | e | Martell, 1974a; Zhang, 1994; |
| <i>Exitianus obscurinervis</i> (Stål) (Homoptera: Cicadellidae) | MX | n, z _e | PPQ Interception |
| <i>Feltia subterranea</i> (F.) (Lepidoptera: Noctuidae) | MX | e | Martell, 1974a; Zhang, 1994 |
| <i>Frankliniella</i> sp. (Thysanoptera: Thripidae) | MX | n, y, z _e | PPQ Interception |
| <i>Geometridae</i> sp. (Lepidoptera) | MX | n, z _e | PPQ Interception |
| <i>Gracillariidae</i> sp. (Lepidoptera) | MX | n, z _i | PPQ Interception |
| <i>Gryllus</i> sp. (Orthoptera: Gryllidae) | MX | n, z _e | PPQ Interception |
| <i>Hellula</i> sp. (Lepidoptera: Pyralidae) | MX | n, z _e | PPQ Interception |
| <i>Heraeus</i> sp. (Heteroptera: Lygaeidae) | MX | n, z _e | PPQ Interception |

Table 2: Pests Associated With *Brassica* spp.

| | | | |
|--|--------|-------------------|--|
| <i>Hyalmenus</i> sp. (Heteroptera: Alydidae) | MX | n, z _e | PPQ Interception |
| <i>Leptophobia</i> sp. (Lepidoptera: Pieridae) | MX | n, z _e | McGuire and Crandall, 1967 |
| <i>Ligyrocoris</i> sp. (Heteroptera: Lygaeidae) | MX | n, z _e | PPQ Interception |
| <i>Lipaphis erysimi</i> (Kaltenbach) (Homoptera: Aphididae) | MX, US | c, o | CIE, 1965; Blackman and Eastop, 1984; Hill, 1975 |
| <i>Liriomyza brassicae</i> Riley (Diptera: Agromyzidae) | MX, US | c, o | Martell, 1974b; Spencer, 1981 |
| Lygaeidae sp. (Heteroptera) | MX | n, z _e | PPQ Interception |
| <i>Lygus</i> sp. (Heteroptera: Miridae) | MX | n, z _e | PPQ Interception |
| <i>Macroderctylus</i> sp (Coleoptera: Scarabaeidae). | MX | n, z _e | PPQ Interception |
| <i>Macroderctylus mexicanus</i> (Burmeister) (Coleoptera: Scarabaeidae) | MX | n, z _e | PPQ Interception |
| Membracidae sp. (Homoptera) | MX | n, z _e | PPQ Interception |
| Miridae sp. (Heteroptera) | MX | n, z _e | PPQ Interception |
| <i>Miselia</i> spp. (Lepidoptera: Noctuidae) | MX | n, z _e | McGuire and Crandall, 1967 |
| <i>Monoxia</i> sp. (Coleoptera: Chrysomelidae) | MX | n, z _e | PPQ Interception |
| <i>Murgantia histrionica</i> (Hahn) (Heteroptera: Pentatomidae) | MX, US | c, o | McGuire and Crandall, 1967; Metcalf and Metcalf, 1993 |
| <i>Myzus persicae</i> (Sulzer) (Homoptera: Aphididae) | MX, US | c, o | Hill, 1975; McGuire and Crandall, 1967; Metcalf and Metcalf, 1993 |

Table 2: Pests Associated With *Brassica* spp.

| | | | |
|---|--------|-------------------|--|
| <i>Neoconocephalus</i> sp. (Orthoptera: Tettigoniidae) | MX | n, z _e | PPQ Interception |
| <i>Neopameria</i> sp. (Heteroptera: Lygaeidae) | MX | n, z _e | PPQ Interception |
| <i>Nezara viridula</i> (L.) (Heteroptera: Pentatomidae) | MX, US | c, o | McGuire and Crandall, 1967 |
| Noctuidae sp. (Lepidoptera) | MX | n, z _e | PPQ Interception |
| <i>Nodonota</i> sp. (Coleoptera: Chrysomelidae) | MX | n, z _e | PPQ Interception |
| <i>Nysius</i> sp. (Heteroptera: Lygaeidae) | MX | n, z _e | PPQ Interception |
| <i>Oedionychus</i> sp. (Coleoptera: Chrysomelidae) | MX | n, z _e | PPQ Interception |
| <i>Pachybrachis</i> sp. (Coleoptera: Chrysomelidae) | MX | n, z _e | PPQ Interception |
| <i>Parthenicus</i> sp. (Heteroptera: Miridae) | MX | n, z _e | PPQ Interception |
| Pentatomidae sp. (Heteroptera) | MX | n, z _e | PPQ Interception |
| <i>Phera centrolineata</i> (Signoret) (Homoptera: Cicadellidae) | MX | n, z _e | PPQ Interception |
| <i>Phthorimaea operculella</i> (Zeller) (Lepidoptera: Gelechiidae) | MX, US | c, o | Martell, 1974a; Zhang, 1994 |
| Pieridae sp. (Lepidoptera) | MX | n, z _e | PPQ Interception |
| <i>Pieris rapae</i> (L.) (Lepidoptera: Pieridae) | MX, US | c, o | PPQ Interception; McGuire and Crandall, 1967 |
| <i>Plodia interpunctella</i> (Hubner) (Lepidoptera: Pyralidae) | MX, US | c, o | Hodges <i>et al.</i> , 1983 Zhang, 1994 |
| Plutellidae sp. (Lepidoptera) | MX | n, z _e | PPQ Interception |

Table 2: Pests Associated With *Brassica* spp.

| | | | |
|---|--------|------------------------------------|---|
| <i>Plutella xylostella</i> (L.) (Lepidoptera: Plutellidae) | MX, US | c, o | Martell, 1974a; Zhang, 1994 |
| <i>Prosaldius</i> sp. (Coleoptera: Curculionidae) | MX | n, z _e | PPQ Interception |
| <i>Prytanes</i> sp. (Heteroptera: Lygaeidae) | MX | n, z _e | PPQ Interception |
| Pseudococcidae sp. (Homoptera) | MX | n, z _e | PPQ Interception |
| <i>Psylla</i> sp. (Heteroptera: Psyllidae) | MX | n, y, z _e | PPQ Interception |
| <i>Psylliodes</i> sp. (Coleoptera: Chrysomelidae) | MX | n, z _e | PPQ Interception |
| Pterophoridae sp. (Lepidoptera) | MX | n, z _e , z _i | PPQ Interception |
| Pyralidae sp. (Lepidoptera) | MX | n, z _e | PPQ Interception |
| Pyraustinae sp. (Lepidoptera: Pyralidae) | MX | n, z _e | PPQ Interception |
| <i>Schizaphis graminum</i> (Rand.) (Homoptera: Aphididae) | MX, US | c, o, y | Blackman and Eastop, 1984; McGuire and Crandall, 1967 |
| <i>Spanagonicus</i> sp. (Heteroptera: Miridae) | MX | n, z _e | PPQ Interception |
| <i>Spodoptera</i> sp. (Lepidoptera: Noctuidae) | MX | n, z _e | PPQ Interception |
| <i>Spodoptera exigua</i> (Hubner) (Lepidoptera: Noctuidae) | MX, US | c, o | Hill, 1975, 1987; McGuire and Crandall, 1967; Metcalf and Metcalf, 1993 |
| <i>Systema</i> sp. (Coleoptera: Chrysomelidae) | MX | n, z _e | PPQ Interception |

Table 2: Pests Associated With *Brassica* spp.

| | | | |
|--|--------|---------------------------------|---|
| <i>Thrips tabaci</i> Lindemann (Thysanoptera: Thripidae) | MX, US | c, o, y | Hill, 1975; McGuire and Crandall, 1967; Metcalf and Metcalf, 1993 |
| <i>Trichoplusia intermixta</i> (Warren) (Lepidoptera: Noctuidae) | MX | n, z _e | PPQ Interception |
| <i>Trichoplusia ni</i> (Hubner) (Lepidoptera: Noctuidae) | MX, US | c, o | McGuire and Crandall, 1967; Hedges <i>et al.</i> , 1983 |
| Nematoda | | | |
| <i>Ditylenchus</i> sp. (Tylenchoidea: Tylenchidae) | MX | k, z _i | Alvarez, 1976 |
| <i>Ditylenchus dipsaci</i> (Kuhn) Filipjev (Tylenchoidea: Tylenchidae) | MX | k, z _i | FAO, 1994; Smith <i>et al.</i> , 1992 |
| <i>Nacobbus aberrans</i> (Thorne) Thorne & Allen (Tylenchoidea: Nacobinae) | MX, US | c, k, o | Alvarez, 1976; Farr <i>et al.</i> , 1989; McGuire and Crandall, 1967 |
| Plant Pathogens | | | |
| <i>Agrobacterium tumefaciens</i> (Smith & Townsend) Conn (Eubacterales: Rhizobiaceae) | MX, US | k, o | Bradbury, 1986; FAO, 1994 |
| <i>Albugo candida</i> (Pers.) Kunze (Oomycetes: Peronosporales) | MX, US | k, o | Alvarez, 1976; Farr, <i>et al.</i> , 1989 |
| <i>Alternaria brassicae</i> (Berk.) Sacc. (Fungi Imperfecti: Hyphomycetes) | MX, US | k, o | Alvarez, 1976; Farr, <i>et al.</i> , 1989; McGuire and Crandall, 1967 |
| <i>Didymosphaeria</i> sp. (Ascomycetes: Loculoascomycetes) | MX | z _e , z _i | PPQ Interception |
| <i>Erwinia carotovora</i> (Jones.) Holl. (Eubacterales: Enterobacteriaceae) | MX, US | k, o | Alvarez, 1976; Bradbury, 1986 |
| <i>Fusarium oxysporum</i> Schlect.:Fr. (Fungi Imperfecti: Hyphomycetes) | MX, US | k, n | Alvarez, 1976; Farr, <i>et al.</i> , 1989 |

Table 2: Pests Associated With *Brassica* spp.

| | | | |
|---|--------|------------------------------------|--|
| <i>Mycosphaerella brassicicola</i> (Fr. Ex Duby) Lindau (Ascomycetes: Loculoascomycetes) | MX, US | k, o | Farr, <i>et. al.</i> , 1989; McGuire and Crandall, 1967 |
| <i>Peronospora parasitica</i> (Pers: Fr.) Fr. (Oomycetes: Peronosporales) | MX, US | k, o | Alvarez, 1976; Farr, <i>et. al.</i> , 1989 |
| <i>Phoma lingam</i> (Tode: Fr.) Desm. (Fungi Imperfici: Coelomycetes) <i>(Leptosphaeria maculans</i> (Desm.) Ces. & deNot. Teleomorph) | MX, US | k, o | Alvarez, 1976; Farr, <i>et. al.</i> , 1989; FAO, 1994 |
| <i>Plasmiodiphora brassica</i> Wor. (Haplomastigomycotina: Plasmiodiphoromycetes) | MX, US | k, o | Alvarez, 1976; Farr, <i>et. al.</i> , 1989; McGuire and Crandall, 1967 |
| <i>Pseudocercospora capsellae</i> (Ellis & Everh.) Deighton (Fungi Imperfici: Hyphomycetes) | MX, US | k, o | Alvarez, 1976; Farr, <i>et. al.</i> , 1989 |
| <i>Rhizoctonia solani</i> Kuehn (Fungi Imperfici: Agonomycetes) | MX, US | k, o | Alvarez, 1976; Farr, <i>et. al.</i> , 1989; |
| <i>Sphaerotheca</i> sp. (Ascomycetes: Pyrenomycetes) | MX | k, z _e , z _i | Alvarez, 1976 |
| <i>Xanthomonas campestris</i> (Pam.) Dows. (Pseudomonadales: Pseudomonadaceae) | MX, US | k | Alvarez, 1976; Bradbury, 1986; |

¹Distribution: MX-Mexico, US-United States²Code: b - Not likely to be a primary plant pest

c - Listed in non-reportable dictionary as non-actionable.

e - Although pest attacks commodity, it would not be expected to remain with the commodity (plant part) during processing

h - Quarantine pest; pest has limited distribution in the U.S. and is under official control as follows:(1) pest listed by name in USDA's pest dictionary, official quarantine action may be taken on this pest when intercepted on this commodity and, (2) pest is a program pest (there is an official Federal or recognized State program for control of this pest beyond its being listed in the pest dictionary as actionable.)

k - Not specifically listed for host, but reported from other hosts in same plant genus/family.

n - Listed in the USDA catalogue of intercepted pests as actionable.

o - Organism does not meet the geographical and regulatory definition for a quarantine pest.

x - Multiple interception records exist.

y - Pest is a vector of plant pathogens

z - Internal feeder: Pest is known to attack or infect commodity and it would be reasonable to expect the pest may remain with the commodity during processing and shipping

z_e - External feeder: Pest is known to commonly attack or infect commodity and it would be reasonable to expect the pest may remain with the commodity during processing and shipping.

5. List of Quarantine Pests

Table 3: Quarantine Pests

ARTHROPODA

Copitarsia consueta Walker (Lepidoptera: Noctuidae)
Diabrotica tibialis (Jacoby) (Coleoptera: Chrysomelidae)
Diabrotica undecimpunctata Mannerheim (Coleoptera: Chrysomelidae)
Diabrotica u. duodecimnotata Harold (Coleoptera: Chrysomelidae)
Diabrotica variegata Jacoby (Coleoptera: Chrysomelidae)
Exitianus obscurinervis (Stal) (Homoptera: Cicadellidae)
Macrodactylus mexicanus (Burmeister) (Coleoptera: Scarabaeidae)
Phera centrolineata (Signoret) (Homoptera: Cicadellidae)
Trichoplusia intermixta (Warren) (Lepidoptera: Noctuidae)

PLANT PATHOGENS

Fusarium oxysporum Schlect.:Fr.(Fungi Imperfecti: Hyphomycetes)

6. Quarantine Pests Likely to Follow Pathway

Table 4: Quarantine Pests Likely to Follow Pathway

ARTHROPODA

¹*Copitarsia consueta* Walker (Lepidoptera: Noctuidae)

¹*Copitarsia* spp. have been reported, in Mexico, to feed internally in cabbage (*Brassica oleracea* var. *capitata* L.) (Martell, 1974a). Thus, there is the potential for similar feeding behavior by *Copitarsia* in other *Brassica* species.

Other organisms in this Assessment, not chosen for further scrutiny, may be potentially detrimental to the agricultural production systems of the United States. However, there were a variety of reasons for not subjecting them to further analysis: they are associated mainly with plant parts other than commodity; they may be associated with the commodity (however, it was not considered reasonable to expect these pests to remain with the commodity during processing); they have been intercepted, as biological contaminants, by PPQ Officers during inspections of these commodities and would not be expected to be found with every shipment. In addition, the biological hazard of organisms identified only to the generic level are not assessed due to the lack of adequate biological/taxonomic information. This lack of biological information on any given insect or pathogen should not be equated with low risk. By necessity, pest risk assessments focus on those organisms for which biological information is available. By developing detailed assessments for known pests that inhabit a variety of niches on the parent species, *i.e.*, on the surface of or within the bark/wood, on the foliage, etc., effective mitigation measures can be developed to eliminate the known organism and any similar unknown ones that inhabit the same niches.

7. Economic Importance: Consequences of Introduction

Pests rated for potential economic importance are evaluated against five biological factors. The cumulative score for these elements is the Risk Rating (USDA, 1995).

| Table 5: Risk Rating - Consequences of Introduction | | | | | | |
|---|------------------|---------------|-----------|----------|--------------------|----------------|
| Pest | Climate/ Host | Host Range | Dispersal | Economic | Environ- mental | Risk Rating |
| <i>Copitarsia consueta</i> | High | High | High | High | Medium | High |

8. Likelihood of Introduction

The likelihood of introduction for a pest is rated relative to six factors (Tables 6 and 7) (USDA, 1995).

| Table 6: Amount of Commodity Shipped | |
|--------------------------------------|--------|
| Number of 40' Containers Annually | Rating |
| 10 - 100 | Medium |

| Table 7: Risk Rating - Likelihood of Introduction | | | | | | |
|---|--|--|--|--|--|--|
| Pest | Quantity of commodity imported annually | Likelihood of surviving postharvest treatment | Likelihood of surviving shipment | Likelihood of not being detected at port of entry | Likelihood of moving to suitable habitat | Likelihood of finding suitable hosts |
| <i>Copitarsia consueta</i> | High | High | High | High | High | High |

9. Pest Risk Potential and Phytosanitary Measures

Pest Risk Potential is the combination of the consequences and likelihood of introductions (Tables 5, 6 and 7) (USDA, 1995).

| Table 8: Pest Risk Potential | |
|------------------------------|---------------------|
| Pest | Pest Risk Potential |
| <i>Copitarsia consueta</i> | High |

Phytosanitary Measures

The summation of the Consequences and Likelihood of Introductions (Tables 5, 6 and 7) yields the Pest Risk Potential (PRP). Organisms rated with Low PRPs may require only Port of Entry inspection to maintain quarantine security. However, pests with Medium to High PRPs may require phytosanitary measures more situation specific than those provided, solely, by inspections.

In the case of *Copitarsia*, Martell (1974a) has indicated that larvae exhibit both internal and external feeding habits. Accordingly, mitigation measures based solely on inspections by PPQ Officers may be inadequate to reduce the pest risk posed by this insect. However, the choice of appropriate sanitary and phytosanitary measures to mitigate risks associated with Mexican species of *Brassica* is undertaken as part of Risk Management, and is not addressed, *per se*, in this document. Should additional pests, not identified in this Risk Assessment, be intercepted, appropriate quarantine action will be taken.

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